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HOOK BOUNCE TEST OF THE E-2A AIRPLANE ARRESTING GEAR "A" FRAME

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13. ABSTRACT

A laboratory hook bounce test was performed on an E-2A arresting gear "A" frame to determine whether the "A" frame could sustain the effects of 3,000 arrested landings. A total of 6,000 simulated hook bounce cycles were applied to the "A" frame during the test with no structural failures. With a test scatter factor of 2, the 6,000 test cycles are equivalent to 3,000 service arrested landings.

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HOOK BOUNCE TEST OF THE E-2A AIRPLANE ARRESTING GEAR "A" FRAME

FINAL REPORT
AIRTASK NO. A510-5103/001-4/3510-000-002
WORK UNIT RJ560

THIS REPORT COMPLETELY CANCELS AND SUPERSEDES THE BASIC REPORT

A laboratory hook bounce test was performed on an E-2A arresting gear "A" frame to determine whether the "A" frame could sustain the effects of 3,000 arrested landings. A total of 6,000 simulated hook bounce cycles were applied to the "A" frame during the test with no structural failures. With a test scatter factor of 2, the 6,000 test cycles are equivalent to 3,000 service arrested landings.

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INTRODUCTION

A limit of 500 arrested landings has been established for the E-2A airplane by the Naval Air Systems Command (NAVAIRSYSCOM). Service usage records indicate that 500 arrested landings will be insufficient to satisfy projected operational requirements for the airplane. A more realistic requirement is the capability to sustain 3,000 arrested landings.

Prior to the fatigue tests for the hook bounce condition, the E-2A "A" frame test specimen had been subjected to 6,000 axial load cycles during the full-scale arrested landing fatigue tests of the E-2A aircraft as per references (a) and (b).

In order to substantiate the fatigue strength of the E-2A "A" frame it must sustain 6,000 test cycles of the hook bounce condition (vertical bending) as per reference (c).

DESCRIPTION OF TEST SPECIMEN

A new E-2A arresting gear "A" frame (Part No. 123CVM10004-1) was procured for the full-scale E-2A airframe arrested landing fatigue tests. See Figure No. 1. Subsequently, this same "A" frame was fatigue tested for the hook bounce condition. See reference (d).

TEST PROGRAM

Since the E-2A test article was drawn from the supply system, it had experienced no arrested landings, the entire 3,000 arrested landings hook bounce condition had to be simulated by testing. A test scatter factor of two (2) required that the number of simulated hook bounce arrestments be increased to 6,000.

The simulated hook bounce loads were applied to a "hook point bar" attached to the E-2A "A" frame as shown in Figure No. 2. Figure No. 3 shows the test set up.

Applied loads, at the "hook point", cycled from 150 pounds minimum to a maximum load of 2,100 pounds at a cyclic rate of 10 cycles per minute.

The control loads, at the dash pot locations, ranged from a minimum of 50/200 pounds to a maximum of 10,000/10,800 pounds, port and starboard, respectively.

When the port and starboard dash pot loads reached 10,000/10,800 pounds respectively, the system would start to unload.

Test loads were applied to the "hook point" by a hydraulic actuator which was part of an electro-hydraulic, servo-controlled, closed loop loading system. Load control was provided by a punched tape reader.

The input load was recorded on a single pen strip chart recorder while the output loads were recorded on a dual pen strip chart recorder. Figures No. 4 and No. 5 show typical sections of these charts.

TEST METHOD

The test specimen was supported in the horizontal position, with the input load actuator in a vertical position.

The input loads were applied perpendicularly to the arresting hook, with the "A" frame free to pivot, the reaction loads being taken out by a pair of 20,000 pound load cells at the dash pot positions, as shown in Figure No. 6. The loads at the pivot points and load cells were taken out by a "strong back" as shown in Figure No. 3.

The cyclic loading was continuous until 6,000 cycles were achieved.

Prior to, and after testing, the "A" frame was X-rayed, and magnetic particle inspection was performed.

RESULTS

A total of 6,000 cycles of hook bounce loading was sustained by the E-2A "A" frame. The X-ray and magnetic particle inspection showed the "A" frame to be structurally sound.

CONCLUSIONS

The E-2A "A" frame is capable of sustaining the effects of 3,000 arrested landings, for the hook bounce condition, without structural modifications.

RECOMMENDATIONS

As a result of this test, it is recommended that the limit of 500 arrested landings be increased to 3,000 for the hook bounce condition.

REFERENCES

(a) NADC Test Plan Report, NADC-72047-VT of 1 May 1972, "Test Plan Report for Arrested Landing Fatigue Test of Model E-2A/B Airplane."

(b) NADC letter VTSD (7866) of 27 September 1972, "E-2A Airplane Arrested Landing and Catapult Fatigue Test, Interim Report."

(c) NAVAIR AIRTASK NO. A-510-5103/001-4/3510-000-002, Work Unit HJ560.

(d) NADC Test Plan Report NADC-72216-VT of 7 November 1972, "Test Plan to Substantiate the Capacity of the E-2A Arresting Hook "A" Frame to Sustain 3,000 Arrested Landings.

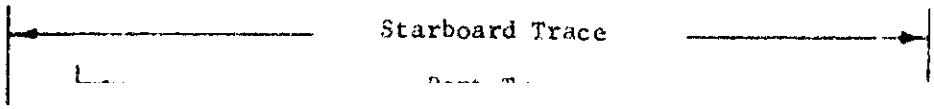
Figure No. 1. E-2A "A" Frame

Figure No. 2. "A" Frame with Simulated Hook

Figure No. 3. E-2A Test Set Up

150#

Figure No. 4. Sample of Test Record - Input



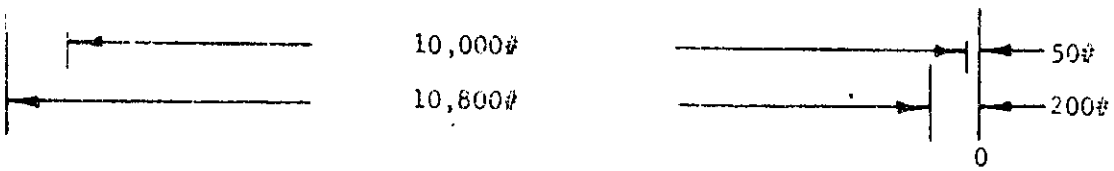


Figure No. 5. Sample of Test Record - Output

Figure No. 6. E-2A Load Diagram

APPENDIX A

The sketch of the E-2A "A" frame depicts the mid points of the area subjected to X-ray and magnetic particle inspection. Of primary importance are the tube welds, pivot fittings, and the dash pot tie in locations.

E-2A ARRESTING GEAR "A" FRAME
LOCATION OF X-RAY & MAGNETIC PARTICLE INSPECTION

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